IN THE DRAWINGS:

Please amend Figures 2 and 3 as shown in the attached Replacement Sheets. In particular, the Replacement Sheet for Figure 2 further illustrates the data lines 53 from the channel estimator 54 to the joint optimizer 74 and further to the prefilter 56 and the DFSE 58. The Replacement Sheet for Figure 3 further illustrates the signal input from the channel estimator 54 to the joint optimizer 74, and the data lines 53 input to the prefilter 56 and the DFSE 58.

REMARKS

The Office Action dated December 19, 2008, has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto.

By this Response, Replacement Sheets for Figures 2 and 3 have been provided to more clearly illustrate the features of certain embodiments of the invention. In particular, the Replacement Sheet for Figure 2 further illustrates the data lines 53 from the channel estimator 54 to the joint optimizer 74 and further to the prefilter 56 and the DFSE 58. The Replacement Sheet for Figure 3 further illustrates the signal input from the channel estimator 54 to the joint optimizer 74, and the data lines 53 input to the prefilter 56 and the DFSE 58. Claims 1-20, 22, 29, 34-35, 39, and 43-45 were previously cancelled without prejudice or disclaimer. No new matter has been added. Support for the above amendments is provided in the Specification at least on page 12, line 3, to page 18, line 17. Accordingly, claims 21, 23-28, 30-33, 36-38, 40-42, and 46-47 are currently pending in the application, of which claims 21, 32, and 38 are independent claims.

In view of the above amendments and the following remarks, Applicants respectfully request reconsideration and timely withdrawal of the pending rejections to the claims for the reasons discussed below.

Drawing Objections under 37 CFR 1.83(a)

The Office Action objected to the drawings under 37 C.F.R. §1.83(a), alleging that the drawings fail to show each component described in the Specification. Specifically, the Office Action alleged that Figure 3 fails to show a signal input from the signal estimator to the "joint optimizer," as described in the Specification on page 12, lines 7-8, and illustrated in FIG 2.

Accordingly, Applicants submit Replacement Sheets for Figures 2 and 3 to more clearly illustrate the features recited in the pending claims, rendering the objections to the drawings moot. The Replacement Sheet for Figure 2 further illustrates the data lines 53 from the channel estimator 54 to the joint optimizer 74 and further to the prefilter 56 and the DFSE 58. The Replacement Sheet for Figure 3 further illustrates the signal input from the channel estimator 54 to the joint optimizer 74, and the data lines 53 input to the prefilter 56 and the DFSE 58.

No new matter has been added. Therefore, Applicants respectfully request consideration of the Replacement Sheets for Figures 2 and 3, and respectfully request that the objections to the drawings be withdrawn.

Claim Objections

The Office Action objected to claims 38 and 40-42, alleging that claim 38 recites features that are not supported in the disclosure of the Specification. In particular, the Office Action alleged that claim 38 recites a feedback filtering means for filtering

optimized values and summed output from the optimizing means and the summing means. The Office Action further alleged that the disclosure of the Specification fails to describe that the feedback filtering means filters optimized values. The Office Action alleged, however, that the Specification describes the feedback filtering means using optimized values to set tap coefficients. Furthermore, the Office Action alleged that the Specification fails to describe that the feedback filtering means filters the summed output from the summing means. Rather, the feedback filtering means is alleged by the Office Action to filter the maximum likelihood values from the MLSE device. Applicants respectfully disagree with the Office Action's allegations.

As described, at least, at page 13, lines 5-18, and illustrated, at least, in FIG. 3, the disclosure of the Specification describes that the feedback filter 92 operates to filter the optimized values provided thereto on the line 60 and to generate feedback-filtered values on the line 96. The values provided on the line 60 are maximum-likelihood values, however, these maximum-likelihood values are generated using summed values on the line 98 from the summing element 94, and therefore the feedback filter 92 operates to also filter the summed values. The feedback filter 92 is also described to filter optimal parameter values provided thereto on line 84 from the joint optimizer 74.

Therefore, contrary to the Office Action's allegations, Applicants respectfully submit that the disclosure of the Specification, at least, at page 13, lines 5-18, and illustrated, at least, in FIG. 3 sufficiently describes the features of the feedback filtering means, as recited in claims 38 and 40-42.

Therefore, Applicants respectfully request withdrawal of the objections of claims 38 and 40-42, and respectfully submit that claim 38, and the claims that depend therefrom, are in condition for allowance.

Claim Rejections under 35 U.S.C. §102(e)

The Office Action rejected claims 21, 23-26, 28, 30, 38, 40-42, and 46-47 under 35 U.S.C. §102(e) as allegedly anticipated by Zangi, *et al.* (U.S. Patent No. 6,775,322) ("Zangi"). The Office alleged that Zangi discloses or suggests each and every element recited in claims 21, 23-26, 28, 30, 38, 40-42, and 46-47. Applicants respectfully submit that the claims recite subject matter that is neither disclosed nor suggested in Zangi.

Claim 21, upon which claims 23-28, 30-31, and 46-47 depend, recites an apparatus. The apparatus includes a signal filter configured to filter a signal from a signal receiver, and a signal estimator configured to estimate channel operations of the signal from the signal filter. The apparatus also includes a signal optimizer configured to generate optimized values for the signal from the signal filter, a prefilter configured to filter the signal from the signal filter using the generated optimized values for the signal, and a decision feedback sequence estimator configured to receive the generated optimized values. The decision feedback sequence estimator includes a summing element, a feedback filter, and a maximum likelihood sequence estimator. The summing element, the feedback filter, and the maximum likelihood sequence estimator are operatively connected to one another and further operatively connected to the prefilter.

An interconnection of the prefilter, the feedback filter, the maximum likelihood sequence estimator, and the summing element is configured to permit concurrent interference and prefilter operations to be performed.

Claim 38, upon which claims 40-42 depend, recites an apparatus. The apparatus includes signal filtering means for filtering a signal from a signal receiver, and signal estimating means for estimating channel operations of the signal from the signal filter means. The apparatus also includes signal optimizing means for generating optimized values for the signal from the signal filtering means, prefiltering means for filtering the signal from the signal filtering means using the generated optimized values for the signal and interference cancelling means for receiving the generated optimized values to perform concurrent interference and prefilter operations. The interference cancelling means includes prefiltering means, summing means for summing inputs from the prefilter means, feedback filtering means for filtering optimized values and a summed output from the signal optimizing means and the summing means, respectively, and maximum likelihood sequence estimating means for generating maximum-likelihood values from the summing means. An interconnection of the prefiltering means, the feedback filtering means, the maximum likelihood sequence estimating means, and the summing means is configured to permit the concurrent interference and prefilter operations to be performed.

Applicants respectfully submit that certain embodiments of the invention provide non-obvious advantages. Specifically, certain embodiments of the invention relate to a multiple-input, multiple-output (MIMO) communication system, whereby

interference cancellation and equalization prefiltering operations at a receiving station of the MIMO communication system are performed. Hence, the system includes a joint encoder, a MIMO transmission, and a MIMO receiver. Whereas, Zangi, Taylor, and Malkemes describe non-MIMO systems, *e.g.*, a single-input, single-output systems. Hence, certain embodiments of the invention provide non-obvious advantages over the cited art references because the combination of receivers described in Zangi, Taylor, and Malkemes fail to provide joint encoding and MIMO transmission/reception.

As will be discussed below, Zangi fails to disclose or suggest each and every element recited in claims 21, 23-26, 28, 30, 38, 40-42, and 46-47, and therefore fails to provide the advantages and the features of the claims discussed above.

Zangi is directed to a method for computing a coefficient of a finite impulse response pre-filter applied prior to a decision algorithm in an equalizer having adjustable filter coefficients. Computations performed to compute the filter coefficients for a right half burst may be used to compute the prefilter for a left hand burst, reducing the number of computations. A square root-free algorithm may be used to solve the system of linear equations, reducing computational complexity (Zangi, Abstract; col. 2, lines 8-39).

Applicants respectfully submit that Zangi fails to disclose or suggest each and every element recited in claims 21 and 38. Specifically, Zangi fails to disclose or suggest, at least, "a decision feedback sequence estimator configured to receive the generated optimized values, wherein the decision feedback sequence estimator comprises a summing element, a feedback filter, and a maximum likelihood sequence estimator," as

recited in claim 21 (emphasis added), and similarly recited in claim 38. However, a review of the description of Zangi demonstrates that Zangi fails to disclose or suggest *each and every element* recited in claims 21 and 38.

Zangi describes an equalizer 100, which may be a decision feedback equalizer (DFE) or a decision feedback sequence estimation (DFSE) equalizer. Equalizer 100 includes an equalization filter 101, a decision algorithm 108, and a processor 120. Equalization filter 101 includes a prefilter 102, feedback filter 104, and a summer 106. Processor 120 includes a channel estimator 122 and an adaptive algorithm 124 (Zangi, Figures 1 and 3; col. 3, line 29, to col. 4, line 60).

As previously noted above, the Office Action cited the feedback filter 104, the summing device 106, and the decision algorithm 108, collectively, to allege that Zangi describes the "decision feedback sequence estimator." The Office Action further alleged that Zangi describes the "decision feedback sequence estimator" including a feedback filter 104, a summing element 106, and a maximum likelihood sequence estimator 108, citing the same three structural elements: the feedback filter 104, the summing device 106, and the decision algorithm 108 (See Office Action on page 5).

Applicants respectfully submit that the Office Action's rejections failed to appreciate each and every element recited in claims 21 and 38. For example, claim 21 recites *four* separate structural elements related to the decision feedback sequence estimator. In other words, claim 21 recites a first structural element, the decision feedback sequence estimator, including three separate structural elements, a summing

element, a feedback filter, and a maximum likelihood sequence estimator, as described in the Specification, at least, at page 13, lines 9-17.

Whereas, the Office Action cited only *three* separate structural elements to allege that Zangi discloses the decision feedback sequence estimator, the summing element, the feedback filter, *and* the maximum likelihood sequence estimator. To support its rejections, the Office Action grouped these three separate structural elements to demonstrate that the decision feedback sequence estimator was described in Zangi, and then subsequently cited the same three separate structural element to allege that Zangi describes a "decision feedback sequence estimator comprises a summing element, a feedback filter, and a maximum likelihood sequence estimator," as recited in claim 21, and similarly recited in claim 38. Thus, the Office Action failed to demonstrate that Zangi discloses *each and every element* recited in claims 21 and 38, and therefore the Office Action's allegation that there is no structural difference between Figure 3 of Zangi and the features of the invention, as alleged on page 12 of the Office Action, is incorrect.

Claims 23-26, 28, 30, and 46-47 depend from claim 21. Claims 40-42 depend from claim 38. Accordingly, claims 23-26, 28, 30, 40-42, and 46-47 should be allowable for at least their dependency upon an allowable base claim, and for the specific limitations recited therein.

Therefore, Applicants respectfully request withdrawal of the rejections of claims 21, 23-26, 28, 30, 38, 40-42, and 46-47 under 35 U.S.C. §103(a) and respectfully submit

that claims 21 and 38, and the claims that depend therefrom, are in condition for allowance.

Claim Rejections under 35 U.S.C. §103(a)

Claim 27

The Office Action rejected claim 27 under 35 U.S.C. §103(a) as being allegedly unpatentable over Zangi in view of Taylor (U.S. Patent No. 2002/0197987) ("Taylor"). Applicants respectfully submit that the claims recite subject matter that is neither disclosed nor suggested in the combination of Zangi and Taylor.

Zangi was discussed above. Taylor is directed to a transparent data transmission for a wireless/cellular communication system. An analog signal from a modem or other source is converted at a remote station to a digital bit stream in accordance with a memoryless compaction rule. The resultant bit stream is then transmitted through a transparent channel that includes a wireless cellular-telephone link. At the base station, that bit stream is transmitted over a public-switched-network span (Taylor, Abstract; paragraphs [0003]-[0005]).

As previously noted above, Zangi fails to disclose or suggest each and every element recited in claim 21. Taylor fails to cure the deficiencies of Zangi. Specifically, Taylor fails to disclose or suggest, at least, "a decision feedback sequence estimator configured to receive the generated optimized values, wherein the decision feedback sequence estimator comprises a summing element, a feedback filter, and a maximum

likelihood sequence estimator," as recited in claim 21 (emphasis added). Accordingly, Zangi in view of Taylor fails to disclose or suggest each and every element recited in claim 21.

Claim 27 depends from claim 21. Accordingly, claim 27 should be allowable for at least its dependency upon an allowable base claim, and for the specific limitations recited therein.

Therefore, Applicants respectfully request withdrawal of the rejection of claim 27 under 35 U.S.C. §103(a) and respectfully submit that claim 21, and the claims that depend therefrom, are in condition for allowance.

Claims 31-33 and 36

The Office Action rejected claims 31-33 and 36 under 35 U.S.C. §103(a) as being allegedly unpatentable as obvious over Zangi in view of Malkemes, *et al.* (U.S. Publication No. 2002/0106040) ("Malkemes"). Applicants respectfully submit that the claims recite subject matter that is neither disclosed nor suggested in the combination of Zangi and Malkemes.

Claim 32 recites a method. The method includes receiving a data vector, forming optimized feed forward filter parameters from the data vector, and forming optimized feedback filter parameters from the data vector. The method further includes transmitting the optimized feed forward filter parameters and the optimized feedback filter parameters to a decision feedback sequence estimator. The decision feedback sequence estimator

includes a feedback filter. The method further includes applying the optimized feed forward filter parameters to a feed forward filter to define filter characteristics of the feed forward filter, applying the optimized feedback filter parameters to the feedback filter to define filter characteristics of the feedback filter, and simultaneously performing interference cancellation and pre-filtering operations on the data vector through operation of the feed forward and feedback filters. Receiving the data vector includes receiving a plurality of data vectors on a corresponding plurality of receiving chains.

As will be discussed below, the combination of Zangi and Malkemes would fail to disclose or suggest each and every element recited in claims 31-33 and 36, and therefore fails to provide the features of the claims discussed above.

Zangi was discussed above. Malkemes is directed to a method and apparatus for reducing multipath distortion in a wireless IAN system. A spatial diversity combiner includes a plurality of feed forward equalizers (FFEs), a decision feedback equalizer (DFE), and a tap control circuit. The plurality of FFEs receive spatially diverse replicas of an RF signal and optimally combine them. The DFE provides feedback for tap weight control and optimal equalization of the transmission channel. Symbol error is generated by a slicer circuit or by a maximum likelihood sequence estimation (MLSE) process (Malkemes, Abstract; paragraph [0006]).

As previously noted above, Zangi fails to disclose or suggest each and every element recited in claim 21. Malkemes fails to cure the deficiencies of Zangi. Specifically, Malkemes fails to disclose or suggest, at least, "a decision feedback

sequence estimator configured to receive the generated optimized values, wherein the decision feedback sequence estimator comprises a summing element, a feedback filter, and a maximum likelihood sequence estimator," as recited in claim 21 (emphasis added). Accordingly, assuming *arguendo* that the description of Zangi and the description of Malkemes could be combined, the combination of Zangi and Malkemes would fail to disclose or suggest each and every element recited in claim 21.

For similar reasons discussed above for claim 21, Applicants respectfully submit that the combination of Zangi and Malkemes would fail to disclose or suggest each and every element recited in claim 32. In particular, the combination of Zangi and Malkemes would fail to disclose or suggest, at least, "wherein the decision feedback sequence.

Claim 31 depends from claim 21. Claims 33 and 36 depend from claim 32. Accordingly, claims 31, 33, and 36 should be allowable for at least their dependency upon an allowable base claim, and for the specific limitations recited therein.

Therefore, Applicants respectfully request withdrawal of the rejections of claims 31-33 and 36 under 35 U.S.C. §103(a), and respectfully submit that claims 21 and 32, and the claims that depend therefrom, are in condition for allowance.

Claim 37

The Office Action rejected claim 37 under 35 U.S.C. §103(a) as being allegedly unpatentable over Zangi in view of Malkemes, *et al.* (U.S. Patent No. 2002/0106040) ("Malkemes"), and further in view of Taylor. Applicants respectfully submit that the

claims recite subject matter that is neither disclosed nor suggested in the combination of Zangi, Malkemes, and Taylor.

Zangi, Malkemes, and Taylor were discussed above. As previously noted above, the combination of Zangi and Malkemes would fail to disclose or suggest each and every element recited in claim 32. Taylor fails to cure the deficiencies of Zangi and Malkemes. Specifically, Taylor fails to disclose or suggest, at least, "wherein the decision feedback sequence estimator comprises a feedback filter," as recited in claim 32. Accordingly, the assuming *arguendo* that the descriptions of Zangi and Malkemes could be combined with the description of Taylor, the combination of Zangi, Malkemes, and Taylor would fail to disclose or suggest each and every element recited in claim 32.

Claim 37 depends from claim 32. Accordingly, claim 37 should be allowable for at least its dependency upon an allowable base claim, and for the specific limitations recited therein.

Therefore, Applicants respectfully request withdrawal of the rejection of claim 37 under 35 U.S.C. §103(a) and respectfully submit that claim 32, and the claims that depend therefrom, are in condition for allowance.

CONCLUSION

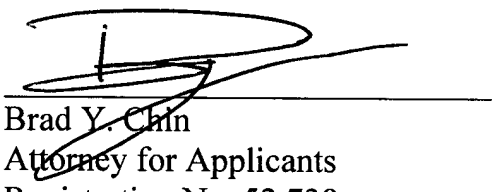
In conclusion, Applicants respectfully submit that Zangi, Taylor, and Malkemes, whether taken individually or in combination, fail to disclose or suggest each and every element feature recited in claims 21, 23-28, 30-34, 36-38, 40-42, and 46-47. The

distinctions previously noted are more than sufficient to render the claimed invention unanticipated and non-obvious. It is therefore respectfully requested that all of claims 21, 23-28, 30-34, 36-38, 40-42, and 46-47 be allowed, and this present application be passed to issuance.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, Applicants' undersigned representative at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, Applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,



Brad Y. Chin
Attorney for Applicants
Registration No. 52,738

Customer No. 32294
SQUIRE, SANDERS & DEMPSEY LLP
14TH Floor
8000 Towers Crescent Drive
Vienna, Virginia 22182-6212
Telephone: 703-720-7800
Fax: 703-720-7802

BYC:dlh

Encl.: Replacement Sheet for Figures 2 and 3